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Title: SOLAR POWERED LIGHTING ASSEMBLY

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This application claims the benefit under 35 U.S.C. 119(e) of U.S. Provisional Application No.60/428,276, filed November 22, 2002.

FIELD OF THE INVENTION

This invention relates to a solar powered lighting assembly, and more particularly to a solar powered lighting assembly adapted to be mounted within an eaves trough.

BACKGROUND OF THE INVENTION

Conventional exterior pot-lighting are commonly used to achieve a desirable decorative soft ambient look for the outside of residential and retail buildings. In fact, halogen pot lights and other forms of high quality recessed lights have become the industry standard.

These kinds of external lighting assemblies often involve complex installation procedures, especially when there is insufficient house or building wiring available to power external lights. In such cases, electricians are required to assist in the design and installation processes and permits are required in order to make adjustments to the electrical work in a home or retail building. When installing lighting to the exterior of a home or retail building, a certified electrician is required to survey the home and inspect the existing wiring to ensure that the building and current wiring meets the specifications and requirements in order for them to proceed. The entire process is time consuming, inconvenient and expensive and the investment made is usually only for the period of time during which a building is occupied.

Further, since industry standard lighting sources are not always the most energy efficient light sources, installation of such lighting sources can result in high installation fees and a substantial increase in associated electricity costs. Additionally, the use of expensive light sources (e.g. halogen) for outdoor lighting applications can result in costly and disruptive damage and breakage due to adverse environmental conditions.

SUMMARY OF THE INVENTION

The invention provides in one aspect, a solar powered lighting assembly for mounting within an eaves trough coupled to an outer wall surface, said lighting assembly comprising:

(a) a lamp;

(b) a rechargeable power source coupled to said lamp assembly to provide operational power to said lamp assembly;

(c) a solar panel assembly coupled to the rechargeable power source to provide electrical power for recharging the rechargeable power source;

(d) a mounting bracket coupled to the inside surface of the eaves trough for supporting said rechargeable power source and said solar panel assembly; and

(e) a connector arm coupled to said lamp, said connector arm being adapted to be removeably coupled in between said eaves trough and said outer wall surface such that said lamp is positioned to provide light on the outer wall surface.

The invention provides in another aspect, a lighting assembly for attachment to an eaves trough mounted on an outer wall surface, said lighting assembly comprising:

(a) a lamp;

(b) a power source connected to said lamp to provide operational power to said lamp; and

(c) a connector arm coupled to said lamp, said connector arm being adapted to be removeably coupled in between said eaves trough and said outer wall surface such that said lamp is positioned to provide light on the outer wall surface.

The invention provides in another aspect, a kit for assembling a solar powered lighting assembly for attachment to an eaves trough mounted on an outer wall surface, said kit comprising:

(a) a lamp;

(b) a rechargeable power source adapted to be coupled to said lamp to provide operational power to said lamp;

(c) a solar panel assembly adapted to be coupled to the rechargeable power source to provide electrical power for recharging the rechargeable power source;

(d) a mounting bracket adapted to be coupled to the inside surface of the eaves trough for supporting said rechargeable power source and said solar panel assembly; and

(e) a connector arm adapted to be coupled to said lamp, said connector arm also being adapted to be removeably coupled in between said eaves trough and said outer wall surface.

Further aspects and advantages of the invention will appear from the following description taken together with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

FIG. 1 is a bottom side perspective view of the solar powered lighting assembly of the present invention;

FIG. 2A is a side perspective view of the lamp assembly of FIG. 1;

FIG. 2B is a top perspective view of the solar powered lighting assembly of FIG. 1 when the solar powered lighting assembly is installed within an eaves trough;

FIG. 3A is a bottom perspective view of the lamp assembly of FIG. 1 when the solar powered lighting assembly is installed within an eaves trough;

FIG. 3B is a side cross-sectional view of the solar powered lighting assembly of FIG. 1 when the solar powered lighting assembly is installed within an eaves trough;

FIG. 4 is a side perspective view of the solar panel assembly of FIG. 1 in an open position to illustrate the internal elements of the solar panel assembly, when the solar powered lighting assembly is installed within an eaves trough;

FIG. 5 is a side perspective view of an alternative lamp assembly for use within the solar power lighting assembly of FIG. 1; and

FIG. 6 is a bottom perspective view of the solar power lighting assembly of FIG. 1 installed within an eaves trough that is mounted to a roof where the connector arm of FIG. 1 extends below the roof such that the lamp element of FIG. 1 is positioned to provide spot lighting on the external wall below.

DETAILED DESCRIPTION OF THE INVENTION

Reference is first made to FIGS. 1, 2A, 2B, 3A, 3B and 4 that show various views of the solar powered lighting assembly **10** made in accordance with a preferred embodiment of the present invention. Solar powered lighting assembly **10** includes a lamp assembly **12**, a solar panel assembly **14** and a pair of mounting brackets **16**. Lamp assembly **12** includes a lighting element **18** and a connector arm **20** that is adapted to be removably secured between the outer wall surface **15** of an external wall and the inside wall **17** of an eaves trough **19**. Solar panel assembly **14** includes a solar panel array **22**, a solar panel housing **24** and a rechargeable power source **26** (FIG. 4). Mounting brackets **16** include an eaves trough connector **28**, bracket support arms **30** and a brace element **32** (FIG. 1).

Lamp assembly **12** includes a lamp element **18** and a connector arm **20**. Lamp element **18** (FIG. 3A) includes at least one lamp **60**, a lamp housing **62**, a lamp shield **64** and a lamp reflector **66**. Lamp **60** is preferably an LED light source since LED light sources are relatively durable, light-weight, and long lasting due to their low power requirements. However, lamp **60** can be any other type of light generating source (e.g. halogen such as the MR11 halogen bulb with a 12 volt or 24 volt transformer, incandescent, etc.) Lamp housing **62** and lamp shield **64** are preferably manufactured out of durable clear plastic and adapted to form a waterproof housing to protect lamp 60 from environmental factors (e.g. rain, corrosion, shock impacts during storms etc.) Lamp shield **64** is specially manufactured out of durable scratch resistant plastic material and acts as a protective lens for lamp **60**. Lamp shield **64** and lamp reflector **66** are used to help direct and disperse light downward and lamp shield **64** is used to prevent loss of light transmission from lamp **60** through lamp shield **64**.

Lamp housing **62** is coupled to connector arm **20** at one end (FIG. 2B) through a rotation joint **57** and rotation pin **58** assembly. As is conventionally known, connector arm **20** includes a rotation cuff **59** within which is mounted rotation pin **58**. Rotation joint **57** is rigidly coupled to lamp housing **62** as shown and can be moved rotatably around rotation pin **58**.

Connector arm **20** includes a wedge-shaped section **40** containing a plurality of wedge-shaped edges **52** (FIG. 2B). Connector arm **20** is preferably manufactured out of a durable flexible and resilient plastic material which is suitable for industrial use. Connector arm **20** is adapted to be inserted and secured in position between the outer wall surface **15** and eaves trough wall **17** such that the wedge-shaped section **50** is positioned adjacent to eaves trough wall **17** (FIG. 2B). When connector arm **20** is inserted between the outer wall surface **15** and eaves trough wall **17** and wedge shaped section **50** is positioned adjacent to eaves trough wall **17**, connector arm **20** can be removably secured at various positions allowing lighting element **18** to be positioned at various desirable distances below the eaves trough **19** as will be described.

Once lighting element **18** is positioned at a desirable distance below the eaves trough **19** (FIGS. 3A and 3B), it is possible to pull the connector arm **20** back slightly so that the closest wedge edge **52** engages the top surface of the eaves trough wall **17** to secure connector arm **20** in place. When it is desired to remove light assembly **12** from solar powered lighting assembly **10**, it is possible to push connector arm **20** up slightly while using an implement (e.g. a screwdriver) to produce a sufficient space gap between outer wall surface **15** and eaves trough wall **17** to allow connector arm **20** to be pulled down and disengaged without any wedge edges **52** being caught on the top surface of eaves trough **19**. It is also possible to break off end parts of connector arm **20** if desired, although since connector arm **20** can be reused, it may be desirable to retain the full extent of connector arm **20**.

While it is preferred to use wedge-shaped section **50** to removably secure light assembly **12** in between outer wall surface **15** and eaves trough wall **17**, it should be understood that various other methods of securing connector arm in between outer wall surface **15** and eaves trough wall **17** could also be utilized. Connector arm **20** and lamp element **18** together provide for a vertically and/or horizontally adjustable light source.

It should be understood that while the preferred embodiment is designed to allow lamp element **18** to be positioned below eaves trough **19** such that light is provided to the wall below eaves trough, it should be understood that lamp element **18** can also generally be used to provide light to any reasonably proximate location on the wall and that lamp element **18** can also be positioned above eaves trough **19** to again, provide light to any reasonably proximate location on the wall.

Solar panel assembly **14** includes a solar panel array **22**, a solar panel housing **24** and a rechargeable power source **26**. Solar panel array **22** contains a plurality of solar panels (FIG. 2A). Solar panel array **22** is preferably implemented using a 0.315 Watt 0.45 volt 700 mA Multicrystalline Silicon solar cells manufactured by Photonic Energy Semiconductor Co. Ltd. In Taiwan.

However, it should be understood that any kind of commercially available solar panels which convert solar energy into electrical energy could be used within solar powered lighting assembly **10**, depending on their rated performance and the environmental conditions contemplated. Each solar panel within solar panel array **22** is electrically connected to one other as is conventionally known.

Solar panel array **22** is preferably fixed within solar panel housing **24**, however solar panel array **22** could also be moveable in various positions to provide for maximum exposure to the rays of the sun. Adjustment to a desired position could be achieved using manual or electrical control means. For example, solar panel array **22** could be manually adjusted at different seasons so that the angle of the array panel is optimized for exposure to the sun. Manual adjustments could be made as seasons change and depending on geographic location of the building on which solar powered lighting assembly **10** is mounted. In another embodiment, the solar array panel may be adjusted using electronic means. The electronic means may be controlled by a remote control. In the latter case, electronic means would be included within solar panel housing **24** (for example in cavity **74**) so that the array panel is self-adjusting and tracks the movement of the sun through the sky either continuously or based on computer programming of the device.

Power control circuit **56** (FIG. 4) is a conventionally designed power circuit implemented on a printed circuit board that is used to regulate the supply of electrical power to the lamp **60** as well as to regulate the flow of electrical energy from the solar panel array **22** to rechargeable power source **26** (i.e. to recharge rechargeable batteries). Power control circuit **56** controls the recharging of rechargeable power source **26** by solar panel array **22** to a selected voltage during the day and turns on lamp fixture **18** at night until rechargeable power source **26** discharged to a predetermined voltage. Solar panel array **22** is electrically connected through wires **78** to power control circuit **56** and accordingly light energy received by solar panel array **22** is converted into electrical energy that is provided to power control circuit **56** that in turn is provided to rechargeable power source **26** in an appropriate form of charge.

Power control circuit **56** includes a light sensor (not shown) to determine nighttime and to ensure that light fixture **18** is not operational during the day and a manual switch (not shown) to adjust the amount of time that the light should be on (e.g. 4 or 8 hours). A red LED charge light (not shown) is used to indicate when electrical energy is being supplied by the solar array panel array **22** to rechargeable power source **26** (i.e. during a sunny day). Also, a wire plug **76** is used to interface the output power from power control circuit **56** to lamp assembly **12** through power wire **54** (FIG. 2B). The specific implementation of power control circuit **56** should be understood to be conventional.

Solar panel housing **24** is used to provide a watertight enclosure for solar panel array **22** and power source **26** as well as a power control circuit **56**, all of which are housed within solar panel housing **24** (FIG. 4). Solar panel housing **24** also includes an end cover **70** that provides a watertight chamber for power source **26** (e.g. AA rechargeable batteries in this case) as shown. When end cover **70** is removed from the end of solar panel housing **24**, it is possible to insert power source **26** (e.g. AA rechargeable batteries) into the chamber within solar panel housing **24** as shown. When end cover **70** is secured onto the end of solar panel housing **24**, the chamber containing power source **26** is made watertight. It is possible to connect a DC adaptor to the DC adaptor pin **72** when end cover **70** is a secured position.

Mounting brackets **16** include a connector element **28**, support arms **30** and a brace element **32**. Mounting brackets **16** are preferably manufactured out of durable plastic material, although it should be understood that any durable material (e.g. stainless steel) could be used instead. The substantially C-shaped top ends of connector elements **28** (FIG. 2A) are adapted to snap-fit onto the top edge surfaces of the inner eaves trough wall **17** as shown. Each connector element **28** includes a groove **29** (FIG. 1, 2B and 3A) that is dimensioned to correspond to the width of the top edge surfaces of eaves trough wall **17**. When pressure is applied to the top of connector elements **28** (i.e. applied by manual pressure), since the grooves **29** within connector elements **28** are dimensioned to correspond to the width of the top edge surfaces of eaves

trough wall **17**, the C-shaped connector elements **28** allow solar panel assembly **14** to be removeably but securely attached to eaves trough wall **17**. However, it should be understood that any other conventional coupling method (e.g. drilled holes in connector elements **28** and small screws, a tension based hook and latch mechanism, etc.) could be used to secure connector elements **28** to top edge surfaces of eaves trough wall **17**.

It should be understood that while it is preferred for the present invention to use a rechargeable power source **26** in combination with a solar panel array **22** to power lamp assembly **12**, lamp assembly **12** could also be powered by any other conventionally available power sources that may or may not be mounted within eaves trough **19**. Rather, it is contemplated that more generally, connector arm **20** could be used to mount lamp element **18** above or below an eaves trough through the use of a wedge-shaped section **50** adapted to be positioned in between a outer wall **15** and eaves trough wall **17** regardless of the particular type of power source used. For example, it is contemplated that lamp assembly **12** could be powered by either an AC or DC power source which may or may not be mounted within the eaves trough **19**. Power could simply be provided from an AC or DC power source that is mounted below the eaves trough or on the wall. In any case, it is contemplated that the present invention also encompasses the use of a wedge-shaped section **50** of connector arm **20** to secure connector arm **20** in the space between outer wall surface **15** and eaves through wall **17** such that lamp element **18** is provided either below or above the eaves trough.

FIG. 5 shows an alternative lamp assembly **112** which can be utilized within solar powered lighting assembly **10**. Specifically, alternative lamp assembly **112** includes connector arm **120** having a wedge-shaped section **150** and a lamp arm **121** from which extends the lamp element **118**. Lamp element **118** includes lamp housing **162**, a plurality of LED lamps **160** as well as lamp shield **164**. As with lamp assembly **12**, lamp **160** is rotatable around a rotation pin **58** that is mounted within rotation cuff **159** that allows for manual adjustment of lamp **160** as well as the light emitted from lamp **160**. It should be understood that

various other types of lamp fixtures **18** can be used within lamp assembly **12**. As discussed previously, it is contemplated that halogen type lamps could be used although such lamps would require slightly stronger support material (e.g. die cast metals) than those contemplated for the LED design discussed above (e.g. durable plastic materials).

FIG. 6 illustrates how the solar powered lighting assembly **10** looks when looking up from the ground and when mounting bracket **16** is coupled to eaves trough wall **17** and connector arm **20** is inserted in between outer wall surface **15** and eaves trough wall **17**. As shown, lamp element **18** is positioned such that lamp **60** is directed to shine light down on the wall surface **150**. As has been described the installation of solar powered lighting assembly **10** is relatively straight forward and can be accomplished rapidly and without the need to re-wire or relay electrical wires around the periphery of the building. As can be seen, solar powered lighting assembly **10** provides the ability to easily accentuate the exterior of a building with a decorative soft ambient light. It is contemplated that solar powered lighting assembly **10** could also be used to provide security lighting, commercial lighting effects (e.g. associated with advertising elements), home decorative effects wherever eaves trough **19** exist and the like.

Solar powered lighting assembly **10** provides a number of advantages over commercially available external lighting assemblies. First, the solar powered light assembly **10** can be easily mounted and removed from an eaves trough **19**. Second, solar powered lighting assembly **10** can be installed within requiring any re-wiring of existing electrical wiring. Solar array panel **22** can be adjustable in order to maximize the exposure of the solar array panel **22** to the angle of the sun in the sky. Also, solar powered lighting assembly **10** is cost efficient and environmentally friendly which will become a more important feature as energy conservation becomes a more important priority. Accordingly, solar powered lighting assembly **10** provides sustained accessibility to sunlight and preserves the aesthetic appearance of the building.

As will be apparent to those skilled in the art, various modifications and adaptations of the structure described above are possible without departing from the present invention, the scope of which is defined in the appended claims. For example, various modifications can be made including improvements to lighting and LED technology, structural changes in terms of the materials used in the design, different types of solar array technology with a variety of types of solar array panels, modifications to the electrical circuitry and the selection of a suitable rechargeable power supply. The design for the lighting assembly of the present invention may be modified or varied to accommodate such changes in technology choices while remaining within the scope of the claimed invention.